Technology-Mediated Progressive Inquiry in Higher Education

Hanni Muukkonen
University of Helsinki, Finland

Minna Lakkala
University of Helsinki, Finland

Kai Hakkarainen
University of Helsinki, Finland

INTRODUCTION

In higher education, students are often asked to demonstrate critical thinking, academic literacy (Geisler, 1994), expert-like use of knowledge, and creation of knowledge artifacts without ever having been guided or scaffolded in learning the relevant skills. Too frequently, universities teach the content, and it is assumed that the metaskills of taking part in expert-like activities are somehow acquired along the way. Several researchers have proposed that in order to facilitate higher level processes of inquiry in education, cultures of education and schooling should more closely correspond to cultures of scientific inquiry (Carey & Smith, 1995; Perkins, Crismond, Simmons & Under, 1995). Points of correspondence include contributing to collaborative processes of asking questions, producing theories and explanations, and using information sources critically to deepen one's own conceptual understanding. In this way, students can adopt scientific ways of thinking and practices of producing new knowledge, not just exploit and assimilate given knowledge.

BACKGROUND

The best practices in the computer-supported collaborative learning (CSCL) paradigm have several features in common: consideration, in an interrelated manner, of the development of technological applications, use of timely pedagogical models, and attention to the social and cognitive aspects of learning. Emphasis is placed on creating a collaborative community that shares goals, tools, and practices for taking part in an inquiry process.

Synthesizing these demands, Kai Hakkarainen and his colleagues at the University of Helsinki have developed a model of *progressive inquiry* as a pedagogical and epistemological framework. It is designed to facilitate expert-like working with knowledge in the context of computer-supported collaborative learning. It is primarily based on Carl Bereiter and Marlene Scardamalia's (Scardamalia & Bereiter, 1994) theory of knowledge building, on the interrogative model of scientific inquiry (Hakkarainen & Sintonen, 2002; Hintikka, 1999), and on the idea of distributed expertise in a community of learners (Brown & Campione, 1994). The model has also been implemented and studied in various educational settings from elementary to higher education (see e.g., Hakkarainen, Järvelä, Lipponen & Lehtinen, 1998; Lakkala, Ilomäki, Lallimo & Hakkarainen, 2002; Lipponen, 2000; Veermans & Järvelä, in press).

THE PROGRESSIVE INQUIRY MODEL

In progressive inquiry, students' own, genuine questions and their previous knowledge of the phenomena in question are a starting point for the process, and attention is drawn to the main concepts and deep principles of the domain. From a cognitive point of view, inquiry can be characterized as a question-driven process of understanding; without research questions, there cannot be a genuine process of inquiry, although in education, information is frequently conveyed or compiled without any guiding questions. The aim is to explain the phenomena in a deepening question-explanation process, in which students and teachers share their expertise and build new knowledge collaboratively with the support of information sources and technology.

The progressive inquiry model specifies certain epistemologically essential processes that a learning community needs to go through, although the relative importance of these elements, their order, and actual contents may involve a great deal of variation from one setting to another. As depicted in Figure 1, the following elements have been placed in a cyclic, but not step-wise succession

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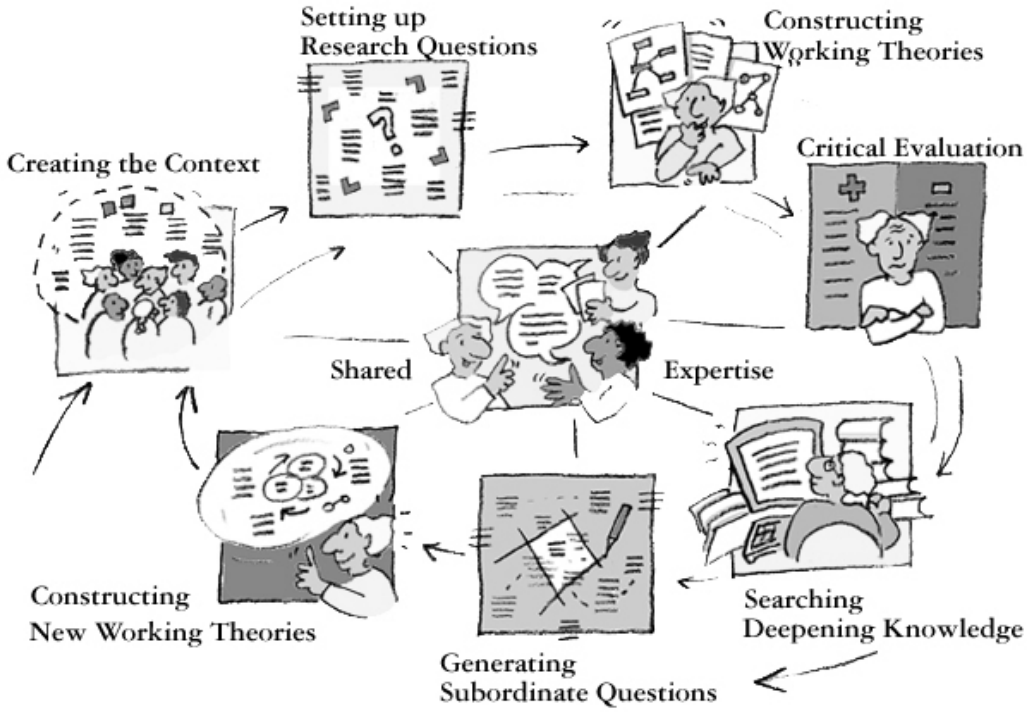
Figure 1. Elements of progressive inquiry (Reprinted by permission from Muukkonen et al., 2004)



to describe the progressive inquiry process (Hakkarainen, 2003; Muukkonen, Hakkarainen, & Lakkala, 1999; 2004).

a) *Distributed expertise* is a central concept in the model. Progressive inquiry intends to engage the community in a shared process of knowledge advancement, and to convey, simultaneously, the cognitive goals for collaboration. Diversity in expertise among participants, and interaction with expert cultures, promotes knowledge advancement (Brown et al., 1993; Dunbar, 1995). Acting as a member of the community includes sharing cognitive responsibility for the success of its inquiry. This responsibility essentially involves not only completing tasks or delivering productions on time, but also learners' taking responsibility for discovering what needs to be known, goal-setting, planning, and monitoring the inquiry process (Scardamalia, 2002). There should be development of students' (and experts') social metacognition (Salomon & Perkins, 1998)—students learning to understand the cognitive value of social collaboration and gaining the capacity to utilize socially distributed cognitive resources.

b) The process begins by *creating the context* to anchor the inquiry to central conceptual principles of the domain or complex real-world problems. The learning community is established by joint planning and setting up common goals. It is important to create a social culture that supports collaborative sharing of knowledge and ideas that are in the process of being formulated and improved.

c) An essential element of progressive inquiry is *setting up research questions* generated by students themselves to direct the inquiry. Explanation-seeking questions (Why? How? What?) are especially valuable. The learning community should be encouraged to focus on questions that are knowledge-driven and based on results of students' own cognitive efforts and the need to understand (Bereiter, 2002; Scardamalia & Bereiter, 1994). It is crucial that students come to treat studying as a problem-solving process that includes addressing problems in understanding the theoretical constructs, methods, and practices of scientific culture.

d) It is also important that students explain phenomena under study with their own existing background knowledge by *constructing working theories* before using information sources. This serves a number of goals: first, to make visible the prior (intuitive) conceptions of the issues at hand; second, in trying to explain to others, students effectively test the coherence of their own understanding, and make the gaps and contradictions in their own knowledge more apparent (e.g., Hatano & Inakagi, 1992; Perkins et al., 1995); third, it serves to create a culture in

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